Still and Video Imagery Data Management Workshop

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ABSTRACT

A workshop to discuss issues relating to the collection, archiving and accessibility of still and video imagery as a source of scientific information was held at the Bedford Institute of Oceanography, March 17 and 18, 2003. The 37 attendees were from several different fields including oceanographic sciences, environmental management, informatics and engineering technologists, representing three of the four DFO Atlantic Zone Regions, private industry and two US research institutions. The purpose of the workshop was to address the priorities defined under the Department of Fisheries and Oceans (DFO) mandate to treat scientific data as national assets under the Science Data Management Policy (SDMP) adopted in July, 2001. TFundamental obligations under the SDMP are to permanently archive scientific data collected by DFO researchers and make it available to the Canadian public. The National Science Data Initiative (SCIDAT) was performed in 2000-2001 in anticipation of this policy and still and video imagery was noted in some collections. The workshop was a combination of presentations and a roundtable discussion to determine the level of imagery use in the Atlantic Zone and propose data management options to meet SDMP obligations. The presentations described some of the uses, collection methods and data management tools that are already in use. What became clear is that SCIDAT underestimated the amount of imagery data used by scientists to provide scientific information about our ocean and freshwater environments. The roundtable was the central focus of the workshop. After 16 presentations the participants were able to identify many of the critical issues facing the Zone in managing these data. The group concluded that there needs to be a second inventory to update SCIDAT and assess the risk of loss of these holdings. It was noted that many of the VHS tapes have exceeded their physical life expectancy and the media has deteriorated significantly putting these older tapes at a very high risk of loss. Protocols using standardized metadata annotation need to be adopted, the use of voice track during collection made mandatory and finally a central clearinghouse needs to be established to permanently archive and make these data available to the public. Specific projects were suggested and potential sources of funding identified

RÉSUMÉ

Un atelier portant sur la collecte et l'archivage d'images fixes et d'images vidéo en tant que sources d'information scientifique, ainsi que sur leur accessibilité, a eu lieu à l'Institut océanographique de Bedford les 17 et 18 mars 2003. Les 37 participants venaient de diverses disciplines, dont les sciences océanographiques, la gestion de l'environnement, l'informatique et les sciences du génie et de la technologie; ils représentaient trois des quatre Régions du MPO dans la zone atlantique, le secteur privé et deux établissements de recherche des États-Unis. Cet atelier avait pour but de débattre des priorités définies en vertu du mandat du ministère des Pêches et des Océans et visant à traiter les données scientifiques comme une richesse nationale, selon la Politique de gestion des données scientifiques du MPO adoptée en juillet 2001. Les obligations fondamentales découlant de cette politique consistent à archiver de manière permanente les données scientifiques recueillies par les chercheurs du MPO et à les rendre accessibles au public canadien. L'initiative nationale en matière de données scientifiques SCIDAT a été exécutée en 2000-2001, préalablement à l'adoption de la politique susmentionnée, et à cette occasion on a noté la présence d'images fixes et d'images vidéo dans certaines collections. Dans le cadre de l'atelier, qui comportait des exposés et une table ronde, les participants cherchaient à déterminer dans quelle mesure on recourait aux images dans la zone atlantique et à proposer des moyens de gestion des données qui soient conformes à la Politique de gestion des données scientifiques. Les présentations décrivaient certaines des utilisations et méthodes de collecte des données ainsi que certains des outils de gestion de ces données qui sont déjà utilisés. Il est apparu clairement que l'initiative SCIDAT a sous-estimé la quantité de données d'imagerie utilisée par les scientifiques pour communiquer de l'information sur les milieux d'eau de mer et d'eau douce. La table ronde a été l'élément central de l'atelier. Après 16 présentations, les participants ont été en mesure de cerner un bon nombre des questions cruciales que pose la gestion des données à l'échelle de la zone. Ils ont conclu qu'un deuxième inventaire était nécessaire pour mettre à jour l'initiative SCIDAT et évaluer le risque de perte de ces fonds de données. On a fait remarquer que de nombreuses cassettes VHS ont dépassé leur espérance de vie utile et que le média s'est détérioré considérablement, d'où un très grand risque de perte de l'information contenue sur ces vieilles cassettes. Il convient d'adopter des protocoles d'annotation standardisée des métadonnées, de rendre obligatoire le recours à la bande vocale pendant la collecte et finalement de créer un centre de coordination pour archiver en permanence ces données et les mettre à la disposition du public. Des projets précis ont été suggérés et des sources de financement possibles proposées.

INTRODUCTION

This report outlines the results of a workshop held at the Bedford Institute of Oceanography on March 17-18, 2003. The workshop focused on the data management of still and video imagery used by marine researchers as a source for scientific information in the study of geological and biological ocean related processes. Regardless of the discipline, there are a few fundamental issues that are generic to working with these data. The workshop was an opportunity for 'like minded' investigators to present how and why they collect images and to discuss options for managing the growing wealth of digital information.

An initial solicitation of interest was sent out by email to 6 potential DFO participants in the Atlantic Zone. The response was very positive and a more formal invitation was sent out to a wider audience including some US contacts working on the subject. There were 55 responses representing all the Atlantic Regions, 36 participants (Appendix 1) attended Day One, 26 on Day Two, and there were 16 presentations (Appendix 2).

This report describes the objectives and organization of the meeting. Abstracts of all presentations are provided, along with a workshop summary and a list of proposed action items and projects. Appendices include a list of participants and workshop agenda. The Powerpoint presentations are available upon request.

Objectives

The Science Branch of the Department of Fisheries and Oceans (DFO) adopted the Science Data Management Policy (SDMP) (*Memoramdum,July 9,2001*) in 2001. In adopting the SDMP, DFO recognizes that scientific data and information are national assets. The policy makes it incumbent upon DFO to archive these assets in perpetuity and make the information accessible to the Canadian public. In regard to still and video imagery it has been recognized that there has not been a discussion within the department on how to deal systematically with these data.

The objectives of the workshop were thus defined as:

1) Increased general awareness of what participants are using video and still images for and collection techniques by soliciting oral presentations from specific researchers;

2) Share information on annotation and processing technologies in use;

3) Discuss data management issues related to geo-referencing, storage, retrieval and processing;

4) Present the infrastructure that is available within DFO Maritimes for the systematic management of this information and identify shortfalls if any;

5) Conclude with a list of standards and objectives with which users and data managers can work from in addressing the possible short and long-term data management solutions.

PRESENTATIONS

(Presentations marked with * available by request to the author)

Use of Video and Photographic Imagery in Studying the Spatial Utilization of Benthic Habitat by Demersal Fish *

Don Gordon
DFO, Marine Environmental Sciences Division, BIO

A large team of DFO and NRCan scientists is conducting a multiyear program on the spatial utilization of benthic habitat by demersal fish, with a focus on juvenile haddock and the Scotian Shelf. This presentation will review overall project organization, the importance of data management, the wide range of data sets that are being collected, and plans for processing and analyzing the extensive video and photographic imagery that is being collected.

Use of Video and Photographic Imagery in Studying the Impacts of Mobile Fishing Gear on Benthic Habitat and Communities *

Kevin MacIsaac
DFO, Marine Environmental Sciences Division, BIO

Using various platforms, DFO collected video and photographic imagery during three large-scale experiments investigating the impacts of mobile fishing gear (otter trawling on a sandy bottom on the Grand Banks, otter trawling on a gravel bottom on Western Bank and hydraulic clam dredging on Banquereau). This presentation will review the imagery that was collected over a broad range of spatial scales, how the imagery was processed, and how the data were managed and analyzed.

Using video records for quantitative descriptions of coral habitats

Pål B. Mortensen & Lene Buhl-Mortensen,
DFO, Marine Environmental Sciences Division, BIO

Information on distribution and abundance of deep-water corals is scarce, but is needed to manage these susceptible habitats in a relevant way, and to enable assessment of human impact. Such data are hard to obtain with traditional benthic sampling equipment (e.g. trawl and dredge) because of the poor spatial resolution and unknown capture efficiency. Fortunately, recent development of Remotely Operated Vehicles (ROVs), submersibles and video equipped towed or drifted gear has provided an opportunity for controlled sampling and detailed observation of deep-water habitats. Over a five years period DFO has collected video imagery from coral habitats at numerous localities between Georges Bank and the Grand Banks. Results from 52 transects video recorded in the Northeast Channel with the ROV, ROPOS, or the video

and still photo camera system Campod are presented. Data on distribution and density of deep-sea corals were provided by analysing video imagery synchronised with simultaneously recorded geographical positions and depths. The results are used to illustrate the possibilities and limitations of this method. Results from Campod and ROPOS are compared. The disadvantages and advantages of the method are compared with high-resolution, small-scale photographic survey

Application of digital imagery to issues in the nearshore zone

Gary Bugden, Ed Horne, Tim Milligan and Peter Cranford
DFO, Ocean and Marine Environmental Sciences Divisions, BIO

This presentation will illustrate the use of digital imagery in several studies in the nearshore zone. These studies include an examination of mussel aquaculture carrying capacity in Northern PEI, an analysis of suspended particulate matter distributions in the Bay of Fundy and a benthic habitat mapping exercise in the Bras d'Or Lakes. Imagery used in these studies includes airborne hyperspectral (CASI), Landsat satellite, aerial photography, both regular and underwater video and stills as well as water column images of in-situ suspended particulate matter. Applications of the imagery include spatial mapping of Chl-a, DOM, SPM and benthic habitat type. Attempts to integrate and quantify the various types of imagery are described.

Photo and video sampling for habitat mapping at GSC(A) *

V. Kostylev
NRCAN, Geological Survey of Canada (Atlanitc), BIO

The presentation will cover photo and video sampling techniques and analysis of optical data for the purpose of mapping surficial geology, benthic communities and habitats of the outer shelf of Nova Scotia conducted by the Geological Survey of Canada (Atlantic).

GSC-Atlantic's aerial coastal video program

Dave Froble
NRCAN, Geological Survey of Canada (Atlanitc), BIO

Since the mid-1980's the coastal group of the Geological Survey of Canada (Atlantic) in cooperation with the Canadian Coast Guard has carried out a program of flying continuous oblique coastal video of the Atlantic provinces and Arctic Canada to provide reconnaissance level information for coastal research. The video is usually shot from a Coast Guard helicopter flying at a height of 100-150metres, about 0.5 km from shore and flying at a speed of 60-90 knots. The coverage includes some of the nearshore showing shallow underwater features, the shoreline and some of the backshore and includes a descriptive commentary of coastal features and location. The videos are

released through the GSC's Open File system and are often accompanied by a report with flight line maps.

What is accomplished with video and still imagery at the DFO, Gulf Region.

Rejean Vienneau
DFO, Gulf Region

It is apparent how video and still imagery is valued as a tool of choice for research, but it is becoming more apparent how it is also welcome for the management of many fisheries. The troublesome free equipment that now exists has made these tools very easy to operate. Let us glance for whom and for what reason we integrate video and still imagery in the Gulf Region. It is worthy to note what is accomplished with these tools. It is also becoming extremely important to develop ways to manage and archive this data, to investigate means of making it accessible and in a manner consistent with the requirements of the National Science Data Management Policy

Lobster habitat mapping, using video information *

Peter Lawton
DFO, Science Branch, St. Andrews Biological Station

An overview on our research program, covering incorporation of video approaches from diving and remote video into groundtruthing of acoustic seabed imagery and definition of lobster habitat associations. My presentation would also cover projected research requirements into the future on image access and geospatial analysis.

Status of database approaches to video management at SABS *

Michael Strong
DFO, Science Branch, St. Andrews Biological Station

Overview of our current technology status and database approaches for aquisition and analysis of remote video survey data and associated environmental data.

Shipboard acquisition and annotation of video and still imagery *

D.L. McKeown
DFO, Ocean Sciences Division, BIO

The presentation will include a description of the Campod and TowCam imaging systems developed at BIO, the collection of complementary data such as position information, and the methodology used to annotate and record the imagery on board the research vessel.

Integrating multibeam visualization with video and still imagery for pipeline surveying.

Ulrich Lobsiger
Consultant for Jacques-Whitford Environmental Services

Presentation of integrated systems for undersea monitoring of gas pipeline on the Scotian Shelf.

TowCam Photos from the Ship to ArcView

Robert Benjamin
DFO, Marine Environmental Sciences, BIO

Metadata processing and management ashore. Use of MS Access database and ArcView to streamline analysis for habitat and benthic community mapping.

Collection, Management and Web Distribution of Underwater Video from the National Undersea Research Program" *

Michael McKee
National Undersea Research Center
University of Connecticut

This presentation will provide a brief overview of NOAA's National Undersea Research Centre (NURC), including research priorities, the primary technologies and science support that are provided to research projects that address these regional and national needs. The NURC Management Information System (MIS) will be presented, which is a replicated, relational database that houses a wide range of information pertaining to NURP funded projects including title, P.I., participants, cruise information, georeferenced dive locations, and products from each dive (i.e., video tapes). Following this introduction the presentation will focus on a more detailed description of the NURC Multimedia Database (MMDB), a database that is linked to the larger MIS that has been designed to store annotation of video clips and associated metadata for archival and retrieval purposes. The MMDB provides the metadata backbone to search for highlighted video clips on NURC's website. Finally, the current and potential applications for the distribution of digital media on the Web (i.e., content queries, keyword searches, interactive mapping) will be presented.

Video Data Management at MBARI *

Judith Connor
Director of Information and Technology Dissemination,
Monterey Bay Aquarium Research Institute

The Monterey Bay Aquarium Research Institute uses high-resolution video equipment to record 300 remotely operated vehicle dives per year. MBARI has developed software to annotate and access video data. The applications reference a knowledge base of biological, geological and technical terms, providing consistent hierarchical information about objects seen on the video. Users can identify locations of video sequences using

a query component that can constrain temporal, spatial, or physical parameters (e.g., season, location, or depth). The annotation, knowledge base, and query components together provide a comprehensive video archive software system that can be applied to a variety of scientific disciplines.

Informatics infrastructure at BIO *

DFO, Marc Hemphill, Systems Analyst, BIO

Depending on the topics covered this talk will provide an overview of our computing facilities at BIO with respect to Volumes, Frequency, Bandwith for internal backups, Bandwith external internet access, media for data exchange, compression, growth issues and future expansion, firewalls, secure access methods and aspects of the Gov't/DFO security policy.

Options for Data Management *

Blink DPI, Gerry Boudreau

Gerry is an executive with Blink Digital Productions Inc. of Halifax. He has the distinction of having worked at BIO as a systems analyst and programmer and has stepped into private industry as an executive with a multimedia production company. He brings to the table extensive technical knowledge of both the manipulation of digital media and a detailed knowledge of BIO computing capacity. His presentation includes a discussion of options and comments on the capacity of BIO to meet the data management needs described in the presentations. His talk was a lead-in to the roundtable discussion.

SUMMARY OF ROUNDTABLE DISCUSSION

The Workshop corroborated the belief that there is a widespread reliance on video and still imagery in contemporary marine science, as well as an obvious requirement to formulate data standards to ensure full legacy value of the acquired material. The opening speaker described a project where diverse sources of digital data were being brought together and emphasized the need for a proper data management system (Gordon). Presentations also described video and stills being used for biological identification (MacIsaac, Connor), stock surveys (Lawton), seabed mapping (Benjamin, Kostylev), coastline erosion studies (Frobel), impact planning (Lobsiger) and impact effects assessments and monitoring (MacIsaac, Bugden, Vienneau). The last presenter described the infrastructure for Mass Storage Medium (MSM) housed at BIO, which could serve as a state of the art archive for imagery data (Hemphill). The presentations identified that there is a large amount of imagery data being collected with project level archival procedures established in a few cases. It was clear that the SCIDAT initiative only scraped the surface of the magnitude of these assets. One presenter described a situation where VHS tapes are unidentified and scattered on shelves while other institutes have sophisticated tape archives with metadata management systems. It was noted that although these data were collected to produce specific scientific information, given the geo-referenced temporal nature of the content, these images could provide valuable insights into human impacts, environmental and species changes over the course of the past 20 years.

There were a variety of collection methods described, ranging from cameras lowered over the side of a small boat to towed vehicles and submersibles. Camera technologies varied from Sony BetaCam producing broadcast quality to DV Cams writing to DVD. All presenters are using digital media but the key limiting factor in sharing these images is the level of metadata associated with the tape or pictures. There is a minimum level of annotation necessary for images to be of value to scientists. Where and when the collections are made are of absolute importance in utilizing these data.

Presentations included systems that have made these references down to the second, storing metadata on the video image and audio track of a digital video tape or in the filename of a digital still (Benjamin, McKeown, Strong), while others have a few notes written on the tape identifying label. Some groups displayed how they were capturing metadata into flat files for later incorporation into databases for subsequent analysis (Benjamin, Connor, Lawton, McKee, Strong). Several presentations described methods of managing the metadata. MS Access and Oracle tables populated with corrected navigation and interpretation data were presented. Two examples of at-sea annotation systems were described. One incorporates a GUI taxonomic search front end (Connors) and another a keypad entry system tracking predefined keystrokes and GPS

time at sea (Strong, McKeown). These tools are valuable resources for referencing the content being collected for later retrieval. One presentation described the need for paying particular attention to the kinds of corrections that are required for proper geospatial interpretation (Benjamin).

A summary presentation was given by an invited industry representative as a lead-in to the roundtable (Boudreau). He reviewed the issues and commented on examples that came out in the presentations. He highlighted the infrastructure and tools that participants have developed. He was very encouraging noting that much infrastructure exists but that the pieces need to be brought together.

The roundtable discussion centered on possible approaches to meeting the DFO Science Data Management Policy objectives of permanently archiving and making accessible science related imagery data through cost effective solutions. An agenda for the roundtable was developed during the workshop based on what was presented. A list of recommended action items and project proposals are listed below. The roundtable was moderated by the convenor who suggested that the discussion be directed on three questions:

- What do we want to archive?
- How are we going to archive what we collect ?
- What would be a good plan of action to identify resources and procedures to make these archived assets accessible and useable?

What do we want to archive?

The discussion led to a recognition that as much video and still imagery as possible should be archived, but that the effort to do so should be prioritized based on how complete the data are annotated. Although some of the data may not be clearly described, they still may have qualitative value and must be accounted for. It was noted that DFO's national Scientific Data Inventory (SCIDAT) seems to have missed these sources of scientific information. An effort to inform the SCIDAT administration of the need to identify and rescue these data sources must be a priority.
Adoption of metadata standards was deemed extremely important. The use of the Canadian Geospatial Data Infrastructure (CGDI) for long term archival and retrieval could be the choice. Adoption of this or any other metadata standard (eg. FDGC, Darwin Core, etc.) may be too onerous and encoding the basic information in some retrievable way is the highest priority. The Geoconnections initiative for the Maritimes Region is timely and relevant. An association with this project may be a valuable source of funding but it was recognized that the CGDI standards are very rigorous and may not work for historical data. The CGDI is based on the U.S Federal Geographic Data

Committee (FGDC) which is also quite rigorous. Getting the minimum temporal, spatial and some of the content metadata is a minimum but the images should be inventoried and archived even if there isn't a complete set of metadata. The participants stressed that we must adopt a standard and ensure that the metadata for all future collections will be collected.

How are we going to archive what we collect ?

The collection of still and video imagery for marine applications crosses divisional, sectoral, regional and departmental boundaries. Given that we are a project driven organization, analysis of newly acquired images often has a narrow purpose and a great deal of information is missed when processing the images. The group concluded that we need a central clearinghouse with the resources to extract more general information from collected images and house the metadata and images for general use. The Monterey Bay Research Institute (MBARI) has developed this kind of annotation facility and the National Underwater Research Centre (NURC) serves as a clearing house of image data for the U.S. marine sciences community. It was noted that the BIO computing facility is in a unique situation in having the storage and processing power to serve as a DFO clearinghouse. Much of the infrastructure already exists, for example the Mass Storage Medium (MSM) and fibre-optic communications infrastructure, but hardware upgrades and dedicated manpower is required to meet the need.

The media on which images are collected has various life expectancies. Film must be stored in a controlled environment to lengthen this limitation and the same goes for digital tape. If a clearing house was built using the MSM, the digitized images are stored on a media that is kept in a controlled environment and backed-up systematically. The participants noted that the best available collection media for video is BetaCam, with a life expectancy of 20-25 years but, different researchers are using different media at the moment. Some are using DVCam and DVDs but DVCam has been recognized as the 'best affordable' solution, although colour losses can occur. It is a stable digital media with a 20 year life expectancy. In addition commercial or 'prosumer' media, a number of reaserchers are using consumer media such as: H:-8mm tape ormini-DV digital tape due to requirements for protability (as in diver applications) or due to limited budgets for equipment. Given hat ancillary expenses of ongoing field operations are often much greater than the video equipment cost, it is a false economy to acquire still and video imagery on consumer media.

The group pointed out that there is a lot of historical data collected on VHS tape. This media only has a 10-15 year life expectancy and actually degrades loosing Chromium Dioxide over time. The tapes can be cleaned and then digitized, but they are loosing valuable resolution and information by the day. There are many tapes that have reached or exceeded their life expectancy and are considered at a Very High Risk of

Loss. The participants stressed that priority effort has to be made to rescue these tapes or the potential resource of information they contain will be lost.

Imagery data themselves have limited value, but when processed into scientific information through interpretation they can become an invaluable scientific resource. In the Maritimes Region, the voice track on video has been used for encoding 'navigation' data digitally. In some other cases the temporal and spatial data are encoded on the images themselves but it seems that most of the images have little or no supporting metadata digitally written to the media. The group decided from this point forward the collection of images must include digitized annotation and that at least the latitude, longitude and time be encoded in some way on the tape or in the filename. For video using the audio track would be the simplest method, either by writing to it digitally or by an oral recording of observations. This encoding will allow for future processing to archive and retrieve clips and pictures from the future clearinghouse. The audio track has an important role as a repository for expert interpretation of the images being collected. At present MBARI and NURC have protocols to collect audio metadata while instrumentation is in the water. It would be a minor alteration in operations to ensure that it becomes mandatory for all future DFO collections. The strides that have been and are being made in voice recognition technology may ultimately allow for the digitization of this information automatically upon collection for permanent storage and access. The technology to encode metadata directly to a channel on the media, which is required to randomly search images placed in a permanent archive, are available on the market. The group noted that these products should be investigated for utility and cost. The question of what to do with tapes that do not have encoded metadata led the point where it was suggested that archiving these are important in that they could be a permanent record and in future the metadata could be amassed through further investigation and interest.

What would be a good plan of action to identify resources and procedures to make these archived assets accessible and useable?

Based on the previous discussion it was clear that there are specific issues that must be addressed and projects developed to deal with them. The first priority is to adopt metadata standards and establish protocols that will be used for all future collections. This would not be an expensive exercise, and given the Region's efforts to create a Geoconnections node at BIO and the infrastructure, costs should be minimal. To accomplish this would require the participation of all participants and some means of educating and effecting the collection of this information. A meeting with the Geoconnections project group to determine what resources are available would be a start. This should be followed by the writing of a set of protocols for the collection of digital imagery, which would be distributed throughout the Atlantic Zone.

The second priority is to inventory the holdings in the Region and rescue images that are on degrading media. Given DFO's commitment to data management and the unique value of image data, the infrastructure that oversees the SDMP should be very interested in supporting this initiative. The goal here would be to design a simple inventory database, based on the chosen metadata standard, and then travel the Atlantic Zone to inventory all our holdings. The architecture of the inventory database must include a means of accessing the information through the DFO Intranet and ultimately as a regional application to allow local updates. Ideally the media conversion or rescue could be performed at the same time. This effort would require the funds for at least a dedicated person-year with a roving individual or by local personnel. Capital funds would also have to be secured to purchase the appropriate tools.

The third priority would be to establish a clearinghouse. This could be a physical or preferably digital library accessible through the Intranet and possibly the Internet. It was noted that the National Archives should be a resource for at least technical if not financial support. Like a museum or library, the original sources should be held in a safe environment. This would require the building of a climate controlled, fire proof location where the original tapes, DVDs, etc. could be housed. At the same time a digital archive would have to be established and the infrastructure to convert digital tape upload (ingest) images into a digital archive, with the appropriate encoding to download the images through some query process. There are probably significant capital costs and there would have to be ongoing technical support to achieve this goal. The inventory described in the previous priority would serve as a first step in building the clearinghouse. Investigations into the physical and software infrastructure, conversion systems and maintenance costs must be done.

Recommended Action Items:

Adopt metadata standards for the collection of video and still imagery used for scientific investigations. Start using audio for verbal annotation as a minimum requirement to establish provenance of the tape material. Other possibilities for digitally recording navigation data (time, position, other variables for the survey equipment in use) directly on the tape material (either via audio or video tracks) should be pursued. Develop protocol based on the adoption of Canadian Geospatial Data Infrastructure (CGDI) standard.

Inventory what imagery data are held in the Zone and prioritize rescue based on completeness of metadata or at least meet minimum. Need design for what is required in the inventory. A web accessible database was discussed so that anyone could search and discover what and where to find video and stills. Include Gulf, Newfoundland and Labrador, Quebec and NRCAN in the planning and implementation.

Old video media (VHS) is degrading and a high priority needs to be placed on the rescue and transfer of the recorded images to new media for long term storage. The life expectancy of VHS tape is 10 years and there are many tapes that were recorded more than or are approaching this age. Researchers have moved to DigiCam and other media (such as Mini-DV). The best media available at present, according to the industry attendees, is BetaCam. BetaCam has a 20-25 year life expectancy but is very expensive and would require the purchase of at least one recorder. Could be problematic as old VHS media may require cleaning. NURC has done this and found it problematic and time consuming.

Cost the extension of BIO video archive on a regional basis and make web accessible inventory. This includes archiving tapes in safe, climate controlled location and having redundant location for copies. Include Gulf, Newfoundland and Labrador, Quebec and NRCAN. Co-ordinate with them in seeking money.

The DFO scientific community needs to establish best practices in the collection and use of digital media. Effects of copying, degradation of media, compression formats and how files should be handled (eg. Do not save over original, optimal recording format, media, care of tapes, etc.).

Technology is needed to read write timecode to channel or some other means to digitally link the metadata to the recorded images. Presenters demonstrated systems that write spatial and temporal information on the image and audio track. Although an important step, ultimately these metadata need to be tagged to the images to allow mass storage archiving and retrieval. The industry representative noted that there are products on the market that can provide these tools.

A project to build a still image archive should be proposed in cooperation with Informatics. Still images represent valuable resources of scientific information and an archive and retrieval system should be fairly inexpensive to develop. A still image archive should allow for the inclusion of short video clips and frame grabs as a precurser to a randomly accessible video archive.
Proposed Projects

1) Adopt standard metadata and audio collection protocol (Coordination by users and listing of minimum metadata standards. Should be done by committee and costs minimal.)

2) Inventory of still and video imagery. For example SCIDAT only lists two projects with these types of data in Maritimes (SCIDAT Data_Id 300MES0062, 110IFD0075). Need to build database to capture relevant information from which a searchable index of holdings could be developed. A survey of holdings would need to be done identifying the specific tape, location of holding, location of coverage, media, camera type, age, general information on contents and owner and physical condition. Keyword lists developed and assigned to tape listings and clips or frames captured would eventually

be made to allow for a search of inventory. Applications will have to be made to SDMP through MEDS for the labour and Geoconnections to build the computing infrastructure and perform the survey.

3) Rescue of VHS holdings is vitally important and needs to be made a high priority. The rescue could be done in conjunction with the inventory but may require specialized equipment for cleaning tapes. Decisions on which rescue media to use will define some of the fixed costs but the effort required will depend on how many tapes need to be rescued. Although it is essential that this work be performed as soon as possible, a systematic approach would reduce the long-term costs. Applications to SMDP and MEDS for data rescue labour, tape and recorder costs.

4) Set up permanent archive, clearinghouse with web based access point.
It is incumbent that DFO build a physical and digital archive for video and still images collected for scientific purposes. A physical archive would involve setting aside one (or many) climate controlled space (s), with fire protection for original tapes that would extend the life and protect the media in perpetuity. The digital archive would require that an inventory system be developed linking indexed digital stills which will be archived in the Mass Storage Medium (MSM) system at BIO. This still inventory system would be designed with the intention to expand it to a randomly accessible video archive once the instrumentation to index and convert video images from tape to the MSM has been purchased. The initial archive's design should also include the infrastructure to allow for frame grabs and short video clips from existing video tapes to be saved to disk and retrievable through the web interface.
As a start BIO houses a collection of the video and still images taken by the Technographics Section and this system should be looked at as a possible model for the inventory. The 'rescue' inventory discussed in Project 2 should be designed to eventually serve as a searchable index of both holdings. Copies of all video and still images taken by Maritimes (Atlantic Zone) DFO researchers would eventually be housed in these archives.

CONCLUSION

Anecdotal information suggests researchers and environmental managers have been using still and video imagery media to collect scientific information for decades. Recent technological developments in image capture combined with computer aided tracking and processing have made the use of digital imagery more desirable. The result of this interest has been the proliferation of uses and recognition that a valuable source of research information is not being archived for future use.

This workshop was promoted to exchange experiences on what researchers and managers are using these data for, how they are being managed and whether there is sufficient need to formalize a data management strategy for digital imagery in the Atlantic Zone.

The workshop brought together users, technologists and people generally interested in the subject. Through presentations and discussion it became very apparent that there is a large quantity of data collected for a wide range of scientific reasons. These data have not been adequately identified and if the Department wishes to meet it's obligations under the Science Data Management Policy there is a clear need for some kind of metadata standardization, archiving and warehousing of these images. The breadth of uses of digital imagery include coastal erosion monitoring, whale identification, benthic habitat classification, aquaculture effects monitoring and impact assessment forecasting, to name a few. What became evident in the presentations and discussions was that vast quantities of valuable historical information are at risk of loss through media degradation and a lack of metadata management.

Through examples from other organizations and discussion it has been established that the technologies exist to rescue these 'at high risk' assets and establish the infrastructure at the Bedford Institute of Oceanography to ensure that the data are collected and properly annotated for permanent archive and retrieval. One of the major benefits of establishing a digital warehouse is the potential for cross-fertilization of relevant scientific information between projects areas. Participants noted that having a properly constructed, 'one stop', portal would allow other researchers and the general public have access to a vast wealth of information related to our oceans.

In conclusion the workshop proved a useful and informative exercise and was very timely in establishing the need to recognize and manage these data. Clearly what was discovered here in the Atlantic Zone is only the tip of an iceberg spanning research activities throughout the country. Follow-up through project proposals is the next step in establishing the Department as a leader in the field.

APPENDIX 1. Workshop Participants

Name	Affiliation	Expertise
Bob Miller	NRCAN	Technician
Charles Mason	DFO	Informatics
Cynthia Bourbonnais	DFO	Research Technician
Dan Jackson	IFD	Researcher
Dave Frobel	GSC-Atlantic,NRCan	Technical Specialist
Dave McKeown	DFO	R&D Engineer
Dave Wildish	DFO	Benthic Ecologist
Don Gordon	DFO	Research Scientist
Gary Bugden	DFO	Physical Scientist
Gerard Costello	CHS	CHS data manager
Gerry Boudreau	Blink DPI	Business Executive
Gordon B.J. Fader	NRCAN	Marine Geologist
Hugh Akagi	DFO	Research Technician
Iris Hardy	NRCAN	Curator, National Marine Geoscience Collections
Jean-Francois Lussier	MPO	Researcher
Jennifer Coppola	Univer. of New Brunswick	Grad Student
Jim Bradford	Univer. of New Brunswick	Researcher
John Tremblay	DFO	Research Scientist
Judith L. Connor	Monterey Bay Aquarium Res. Ins. (MBARI)	Director of Information and Technology Dissemination
Kelly Bentham	DFO	Oceanographic photo Tech.
Kevin McIssac	DFO	Research Technician
Lene Buhl-Mortensen	BIO	Benthic Ecologist
Lou Van Eeckhaute	DFO	Researcher in stock assessment
Marc Hemphill	DFO	Informatics
Michael McKee	NationalUndersea Research Center (NURC)	Information Management
Mike Strong	DFO	Research Technician
Pal Mortensen	BIO	Research Fellow
Patricia Gonzales	BIO	Research Biologist
Peter Lawton	DFO	Research Scientist
Pierre Clement	DFO	MESD Data Manager
Réjean Vienneau	DFO	Marine Electronics - Science
Robert Benjamin	DFO	Data ManagementTechnician
Robert Nowlan	DFO	Data Management Coordinator (Gulf

		Region)
Sean Corrigan	DFO	Research Biologist
Stephen Smith	Invertebrate Fisheries Division	Research Scientist
Steve Campana	MFD	Researcher
Tana Worcester	DFO - IFD/MFD	Oil and Gas Environmental Assessment - coordinator
Tobias Spears	DFO	Systems Analyst
Ulrich Lobsiger	Jacques-Whitford	Independent businessman
Vladimir Kostylev	NRCAN	Benthic Ecologist

APPENDIX 2. Workshop Agenda

	17-Mar-03
	George Needler Boardroom
8:30-8:50	Introduction and Welcome Pierre Clement
8:50-9:15	Use of Video and Photographic Imagery in Studying the Spatial Utilization of Benthic Habitat by Demersal Fish Don Gordon
9:15-9:45	Use of Video and Photographic Imagery in Studying the Impacts of Mobile Fishing Gear on Benthic Habitat and Communities Kevin McIsaac
9:45-10:15	Using video records for quantitative descriptions of coral habitats Pål B. Mortensen
10:15-10:30	**Break**
10:30-11:15	Application of Digital Imagery to Issues in the Nearshore Zone Gary Bugden
11:15-12:15	Photo and video sampling for habitat mapping at GSC(A) Vladimir Kostylev
12:15-1:00	**Lunch**
1:00-1:30	GSC-Atlantic's aerial coastal video program Dave Frobel
1:30-2:00	What is accomplish with video and still imagery at the DFO, Gulf Region Rejean Vinneau
2:00-2:30	Lobster habitat mapping, using video information Peter Lawton
2:30-3:00	Status of Database Approaches to Video Management at SABS Michael Strong
3:00-3:20	**Break**
3:25- 4:00	Shipboard Acquisition and Annotation of Video and Still Imagery D.L.McKeown
4:00- 4:30	Integrating Multibeam and photographic imagery in undersea pipeline surveying Ulrich Lobsiger
4:30-5:00	**Summary**

	18-Mar-03
	George Needler Boardroom
8:30-8:45	Introduction and Summary of Day One Pierre Clement
8:45-9:30	TowCam Photos from the Ship to ArcView Robert Benjamin
9:30-10:15	Video Data Management at MBARI Judith Connor
10:15-10:30	**Break**
10:30-11:15	Collection, Management and Web Distribution of Underwater Video from the National Undersea Research Program Michael McKee
11:15-12:00	Informatics infrastructure at BIO Marc Hemphill
12:00-1:00	**Lunch**
1:00-1:30	Technical Summary and Recommendations Gerry Boudreau
1:30-3:00	Roundtable Begins Moderator Pierre Clement
3:15- 3:30	**Break**
3:30-3:45	**Summary and Conclusion**